North Carolina Highway Bulletin

VOL. IV MARCH, 1923 NO. 1

SCENE ON PROJECT NO. 436—HARNETT COUNTY—RALEIGH-FAYETTEVILLE ROAD

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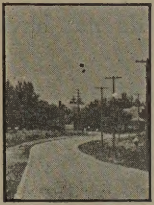
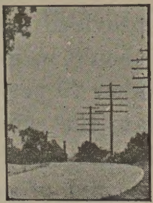


NORTH CAROLINA HIGHWAY BULLETIN



VOL. IV, NO. 1 H. K. WITHERSPOON, Editor MARCH, 1923

"What North Carolina *is* Doing"

By FRANK PAGE, *Chairman*, North Carolina State Highway Commission, Raleigh, N. C.

MR. CHAIRMAN, Ladies and Gentlemen of the Virginia Good Roads Association,—Your Program Committee, in giving me the subject, "What North Carolina Is Doing," without putting a limitation on the time I should speak, has probably put you in for a week's talk.

It has been stated in the past that North Carolina was a "valley of humility," located between two mountains of conceit. I said in the "past." Today North Carolinians look any man in any State square in the eye, and with a great deal of pride say, "I am from North Carolina," with special emphasis on "North."

I came here today to tell you something of the achievements, and something of the failures that we have made in our North Carolina road program, so that you, by knowing our achievements and failures, may be better able to work out a road system satisfactory to your State. I will promise you, however, that this speech of mine will have no similarity to a cat's tail—that is, not "fur" to the end. Also I want to state to you that I have no pride in this speech as a literary production, and if any one at any stage of my talk desires to ask any questions I shall be very glad to answer them as best I can.

NORTH CAROLINA

As soon as you get to No'th Ca'lina
The roads and the towns get newah and finah,
The people walk with a brisker step,
And even your motor has more pep.
The hookworm's banished, the country has
A lot more energy, pep and jazz,
The livest Northerner couldn't design a
Livelier State than No'th Ca'lina.

The farms look fatter, the hamlets ain't
Quite ignorant of the sight of paint,
They're building roads, and they are not content
With sand and clay, but they use cement.
And the schools look good, and the mills are busy
And each inhabitant owns a Lizzie,
Or a big twin six or something finah,
As soon as you get to No'th Ca'lina!

This State's not dreaming of days gone by,
There's a modern glint in each mortal's eye,
And the village belles and village beaux
Are as smartly dressed as the crowd which flows
On Gotham's streets. You must give 'em credit,
These folks are fully awake, you said it!
You meet the "boostah"; you lose the "whinah."
As soon as you get to No'th Ca'lina!

—BERTON BRALEY.

Start of Road Progress.

I think it is best to begin at the start of our road progress. All civic developments come either by evolution or revolution. In North Carolina our road development has been by evolution. I will relate our experience by beginning with the 1915 Legislature step by step. Probably some of you Virginians will recognize the place that we passed you going up. In 1915 the first legislation relative to the North Carolina highway system was enacted. There was a bill enacted into law that contributed the sum of $10,000.00, and appointed a State Highway Commission of three men with Governor and State Geologist as ex officio members, and appointed an engineer. In the caption of the bill it was provided that this engineer and his associates "should develop, build and maintain a State highway system adequate to the State's needs." At the end of that period the $10,000.00 had been spent, and so far as I know there had been no other visible results. In 1917 the Legislature continued the $10,000.00 appropriation, but also added the work of certain State convicts, and with the aid of this convict force and this magnificent sum of money this Commission was able to start a State system.

People Demanded State System.

Prior to 1919 the Good Roads Association of North Carolina, by hard and vigorous work, made our people have a State conscience. That is, they made the folks of North Carolina realize that the State of North Carolina owed something to its citizenship. This Good Roads Association from 1917 to 1919 worked continuously in creating a public sentiment in the State that demanded that the State have a system of highways built, owned and maintained by State funds.

In 1919 the law was changed so that the Governor appointed a new Highway Commission of four men, and the law provided that 30 per cent of the automobile license fees should be used by the State as a construction fund, the other 70 per cent of the automobile license fees going back to the counties for assistance in their road work. Under this law the State Highway Commission was able by the aid of certain counties and the use of 30 per cent of the automobile fees, together with the funds received from the Federal government, to build a limited amount of roads. These roads, however, were scattered throughout the State, and did not make a continuous highway.

Demanded System Be Built.

In 1921 there was a determined effort by North Carolinians to impress the Legislature that we must build a State system of roads, not by piecemeal, or a little piece here and a little piece there, but a continuous State system, and that it was the State's obligation to build roads in the poorer counties which were not able to meet the requirements of putting up 50 per cent of the cost of the road so they could get Federal aid money. At this time the Good Roads Association of North Carolina inaugurated a campaign and went before the Legislature and the people, demanding that we have a real road system. They demanded that we have ample money to build a State system of highways, not a small section each year, but a State system that would be serviceable to this generation. When the pending bill was voted upon by the Legislature the Good Roads Association started fires back home, and hundreds and thousands of letters and telegrams poured in to the Senators and Representatives at Raleigh demanding that they vote for the pending bill. The Legislature passed a law providing the issuing of $50,000,000.00 in bonds to build a State highway system.

No Tax on Real Estate.

We were enabled to build this by capitalization of our automobile fees and a tax of one cent per gallon on the gas sold. We did not tax real estate, and not a single, solitary dollar is collected from any man in North Carolina as a tax on property for State road purposes, nor is any man in North Carolina who does not own a motor vehicle going to pay a single, solitary dollar on the cost of our State improved road system.

Expended $20,000,000.00 in 22 Months.

Under the 1921 road law we were able to produce some results. During the past year and ten months the State Highway Commission has been able to spend about $20,000,000.00 in road construction. We economically spent $20,000,000.00, and we wish to impress upon you the importance of having a real organization in undertaking this work. I understand that the Virginia Highway Commission has a splendid organization, and are ready to produce results for your State. They, however, have not ample funds to economically build a State road system. There are three things necessary in the building of roads: First, time; second, work; third, money. As I understand it, you have ample time, and Mr. Shirley is ready to do the work, but you do not have the money.

Built 1,370 Miles in 18 Months

In the spring of 1921 the North Carolina Highway Commission started its organization in the building of our road system under the bond issue. At the end of 1922—say a year and six or seven months—we have constructed from the proceeds of this $50,000,000.00 bond issue 1,370 miles of improved roads. Four hundred and forty-three miles of this was pavement and 930 miles of other types. We had, however, under construction on the last day of December, 1922, projects amounting to $36,400,000.00, and, to show you the progress that we are making, our contractors' estimates for the month of November was $2,200,000.00, and in December, on account of weather conditions, it was materially reduced, but still we paid out to the contractors $1,200,000.

Attracts Contractors From Other States.

At the beginning of 1922 the State Highway Commission, realizing the unusual conditions then prevailing in the labor and material market, and the incessant demands for roads in the State, and further realizing that it was an economic proposition to build roads faster than we at that time contemplated, determined that we would let to contract in 1922 1,000 miles of roads. This large program enabled us to induce contractors to come in from at least one dozen different States, and by awarding contracts, not in one, two or three-mile sections, but in eighteen, twenty and thirty-mile sections, we were able to induce the largest and best contractors in the Union to come to our State. Some of these men today on a single project have one quarter of a million dollars' worth of equipment. These contractors came to us from Illinois, Pennsylvania, Missouri, Texas, Louisiana, Tennessee and Virginia, and I say to you that each of these States sustained a distinctive loss when a good road contractor moved out of their State.

Roads Best Investment.

Today we are building roads at the rate of fifty miles of pavement and seventy-five miles of other type of roads per month. You say it costs money. You say that we are spending large sums of money. Yes, we are spending large sums of money, but in my opinion it is the best investment that any State in the Union can make. The very fact that we had large sums of monev to spend enabled us to secure contracts at a much more advantageous figure than if we had been forced to let these projects in very short pieces.

Bond Plan Saves $5,000,000.

We are confident that we had a saving in the contracts let in 1922 by the method above described of at least $5,000,000.00 over what the roads would have cost if we had been forced to continue this road-building pro-

(Continued on page 10)

Reasonable Interpretation *of* State Highway Specifications

C. N. CONNER, *Asssistant Engineer*, N. C. State Highway Commission

IN order to secure a reasonable and rational interpretation of specifications the contract must be clear and definite, the engineers and contractors must be unprejudiced, intelligent and fair-minded; while the Highway Commission, itself, must have confidence in its engineers, and demand the respect of its contractors.

The commission should take care of policies and agreements, the engineer with design and supervision of survey and construction; the contractor should take care of the actual construction as called for in his contract.

All of this sounds very easy, but when the personal equation enters in, trouble may or may not result.

Selfish, personal and opinionated decisions are usually disastrous. Any point in question should always be decided on its own merits with the "self" entirely eliminated.

There is often an honest difference of opinion, but if possible the specification should have but one interpretation. A thorough knowledge of the work itself on the part of the engineer and contractor will avoid many misunderstandings.

The old so-called "blanket clause" is becoming less and less popular; it means nothing or anything and is therefore worse than useless.

Contractors sometimes have said, when they sign a contract, that they are signing away everything but their wife and children; what can we engineers as interpreters of specifications say to this?

To the engineers' discredit, it can be said that contractors have been broken by unfair and unintelligent decisions.

Such things as this result in the contractor bidding on inspection and engineering instead of on the performance of the work itself, a condition which must and can be avoided by maintaining an organized engineering force which has definite specification, unselfish motives, and an average degree of intelligence.

It is a mistake for engineers, in North Carolina, for example, to copy verbatim, the specifications of another State or even the specifications of the Bureau of Public Roads. Conditions are not the same in all parts of the country; frost action is a serious consideration in some of the Northern States but is of minor importance in others. A gravel road specification which can easily be met in Maine or Wisconsin will not fit the conditions at all in Western North Carolina, where we must use the local material even though it be inferior to Maine and Wisconsin gravel.

Suppose, for example, a contract was let for a gravel surfacing, the engineer had copied a very drastic specification as to quality and grading of the material but had not investigated the local material, or at least, had not realized that it could not pass his specification; the contractor finishes his grading and starts using the local gravel for surfacing; the inspector finds that the gravel does not meet the requirements and that none can be found locally which does. What then? Who is to blame?

If the contractor is obliged to ship in material he will "go broke."

It is plainly necessary to make a reasonable interpretation of the specifications or to draw up a subsequent agreement permitting the use of the local material.

It is not difficult to draw up a specification for absolutely the best construction, but it does require considerable forethought to adopt the specification to local conditions, especially when good materials are scarce, local conditions vary by a wide margin, and economy must be exercised.

For these reasons North Carolina is building practically every type of road and is adopting that type which will best utilize local materials, serve traffic conditions, and maintain healthy competition in bidding.

On nearly every job of any magnitude the contractor raises the question as to whether or not he should perform a certain piece of work. To settle this the engineer must be familiar with his specifications (whether they be good or bad). The work, however, must be done. If it is within the specifications it should be paid for at the contract unit price; if not, a price should be agreed upon or the work paid for on a cost plus basis.

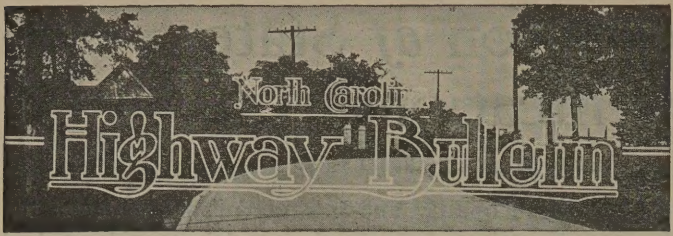
The practice of paying for extra work by increasing the quantities on some other item, such as throwing it into excavation or borrow, is not good business and should be avoided.

The phrase "with written permission of the Engineer" is important to the engineer, as well as the contractor; it is nothing more or less than good business practice. It puts in writing the authority for doing work in a manner which may be different from that called for in the specifications.

Some contractors have performed work which they honestly felt was outside the specifications in order to avoid disputes with their engineers; this is not right. There is really no good reason why the contractor or his representative and the engineer or his representative cannot get together and discuss, peaceably, any point on the work. It is done in every other line of business; why not in ours?

The engineer or inspector who attempts to threaten or penalize a contractor by taking unfair advantage of his position, is in serious danger of losing his job. Unfair

(Continued on page 11)



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Address all communications in regard to Bulletin to the Editor, Box 1140, Raleigh, N. C.

This Bulletin will be sent gratis to any State or county official, contractor, newspaper, trade publication, library, or other person interested in the improvement of roads and in the work of the Commission. Advertising rates may be obtained on application.

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Editorial

Our cover picture this month shows a section of State Project No. 436, Harnett County, a section of the Raleigh-Fayetteville Highway, and also shows how guard rails are being placed on dangerous curves and fills for the protection of the travelling public.

Northern tourists who have been wintering in Florida have begun migrating homeward and a large number inquire at the offices of the Commission for road information. These are almost unanimous in their praise of North Carolina roads. While not meaning to be boastful at all we are proud of our maintenance organization and of the condition in which our roads are kept.

The second letting of the year will be held on April 3rd when bids will be opened on projects totalling approximately 180 miles. Judging from the number of requests for proposals, bidding will be close for the work. A serious shortage of cement will doubless prevent further letting of hard-surface work for some time.

Salient features of the 1923 specifications, under which future work will be let, are reviewed briefly on pages 11 and 18 in the article by Assistant Engineer C. N. Conner.

The attention of contractors and others receiving notices of the letting on April 3rd is called to the sheet attached to these notices. A revision of the mailing list will be made shortly and future notices sent only to those returning the above sheets.

On account of shortage of material, it was impossible to publish the District Notes as planned. It is hoped that sufficient news will be received to warrant the publication of the department in the April issue.

Contracts *to be* Let April 3rd.

THE second large letting of 1923 will be held on April 3rd when bids will be opened on twenty-five projects totaling 179.02 miles of road. Of this mileage 114.85 miles will be immediately hard surfaced, while 64.17 miles will be graded and in some cases surfaced with topsoil, sand-clay or gravel. The work to be let is as follows:

First District

Project No. 115, Chowan-Perquimans counties, consists of 11.83 miles of road on route No. 342 between Edenton and Hertford. Bids are asked on the standard types of paving.

Project No. 146, Hertford-Bertie counties, consists of 6.42 miles of road between the Northampton County line and Aulander, on route No. 305. Bids are asked on topsoil, sand-clay and gravel surfacing.

Project No. 151-B, Hyde County, consists of 4.39 miles of paving between Swan Quarter and Rose Bay.

Plans may be seen at the office of District Engineer at Tarboro, N. C.

Second District

Project No. 213, Craven County, consists of grading, draining and hard-surfacing 10.43 miles of State highway between Fort Barnwell and Jasper, on route No. 10. Bids are asked on standard types of paving.

Project No. 293, Wilson County, is located between the town of Wilson and the Greene County line, a distance of 9.00 miles, on route No. 91. Bids are asked for grading, draining and paving on this project.

Plans may be seen at the office of District Engineer at Kinston, N. C.

Third District

Project No. 329, Columbus County, consists of paving 12.89 miles on route No. 20 between Bolton and Wilmington. Grading on this work was done on a previous contract.

Project No. 392, Robeson County, consists of grading, draining and surfacing 1.06 miles on route No. 211, from the Bladen County line towards Bellamy. Bids are asked on topsoil, sand-clay or gravel surfacing.

Plans may be seen at the office of District Engineer at Wilmington, N. C.

Fourth District

Project No. 408, Durham County, consists of 0.47 miles of paving on the outskirts of the City of Durham.

Project No. 437, Harnett County, consists of 10.74 miles of State highway between Lillington and Duke, on route No. 60. Bids are asked on grading, draining, and topsoil, sand-clay or gravel surfacing.

Project No. 457-A, Orange County, consists of 7.45 miles of graded road from Hillsboro to the Durham County line, on route No. 10.

Project No. 485-A, Wake County, consists of 7.81 miles on route No. 50 between Neuse and the Franklin County line. For the present bids are asked only on grading and structures.

Plans may be seen at the office of District Engineer in Durham, N. C.

Fifth District

Project No. 570, Moore County, consists of 22.10 miles of highway between the Montgomery County line and Aberdeen, on route No. 70. Bids are asked on grading, draining, and topsoil, sand-clay or gravel surfacing.

Project No. 578, Randolph County, consists of 7.97 miles of highway, between Randleman and Asheboro, on route No. 70. Bids are asked on grading, drainage, and hard-surfacing.

Plans may be seen at the office of District Engineer at Greensboro, N. C.

Sixth District

Project No. 616, Cabarrus County, consists of 8.59 miles of road, between the Mecklenburg and Stanly County lines, on route No. 27. Bids are asked on grading, draining, and topsoil or similar surfacing.

Project No. 643, Iredell County, consists of 8.57 miles of highway, between Statesville and the Rowan County line, on route No. 10. Bids are asked on grading, draining, and hard-surfacing.

Project No. 659, Mecklenburg County, covers the construction of bridges and culverts on that section of route No. 27 between Charlotte and the Cabarrus County line.

Plans may be seen at the office of District Engineer at Charlotte, N. C.

Seventh District

Project No. 713, Ashe County, consists of the grading and hard-surfacing of 3.53 miles of highway, between Jefferson and Orion, on route No. 17. Structures on this project have previously been let.

Project No. 723, Caldwell County, consists of grading and surfacing with penetration or waterbound macadam 3.54 miles of highway, between Patterson and the Watauga County line, on route No. 17.

Plans may be seen at the office of District Engineer at Elkin, N. C.

Eighth District

Project No. 802, Avery County, consists of 5.67 miles of highway on route No. 175 between Newland and Elk Park. Bids are asked on grading, drainage structures, and surfacing with either penetration or waterbound macadam.

Project No. 804, Avery County, covers the construction of a bridge over Horse Shoe Creek on route No. 69.

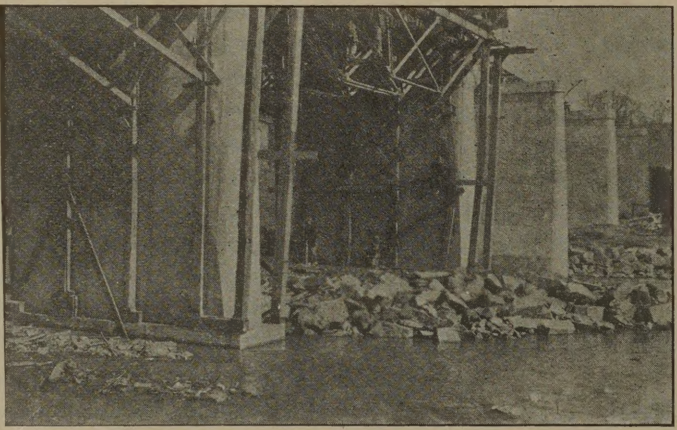
Project No. 835, Henderson County, consists of 6.97 miles of State highway between the Buncombe and Hen-

(Continued on page 9)

Falsework *at* Haw River Bridge Fails

AN accident somewhat unusual in nature happened on Project No. 503, the new bridge over Haw River, at the town of the same name, when the falsework supporting one of the spans collapsed and precipitated the entire span into the river and injured several men who were working on the bridge. According to reports of Construction Engineers of the Commission who visited the accident shortly after its occurrence the failure was due to the contractor's failure to provide sufficient support to the steel I-beam underslung trusses which constituted the falsework proper.

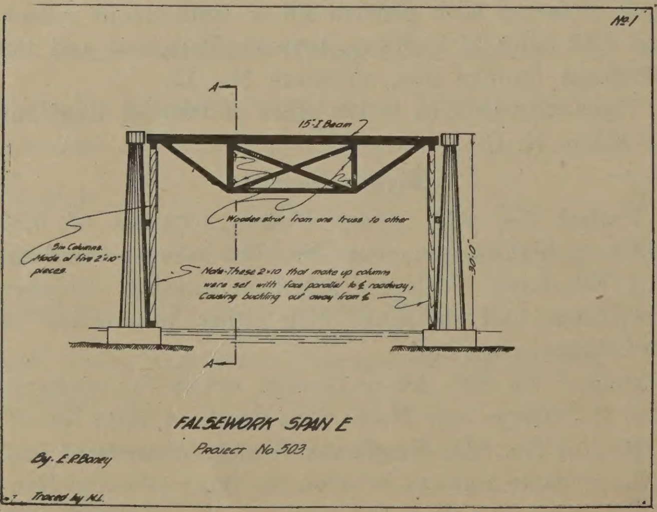
The bridge consists of eight 50-foot reinforced concrete deck girder spans with a clear roadway 20 feet wide and two 5-foot sidewalks, the whole supported on plain concrete piers and reinforced concrete abutments.



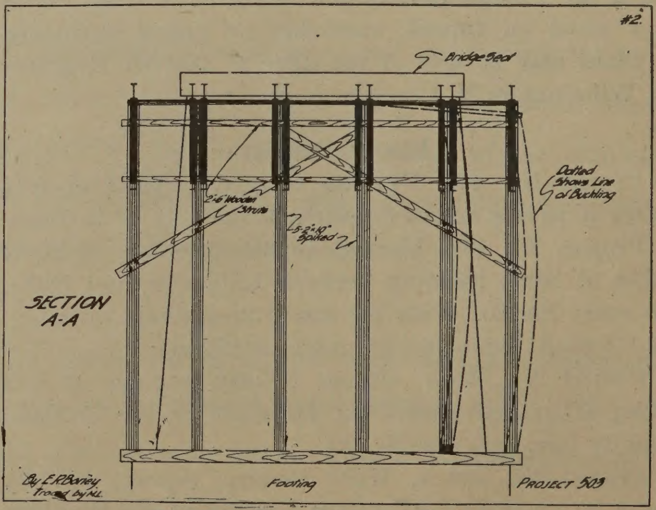
SHOWING UNDERSLUNG TRUSSES AND COLUMN BENTS. NOTE BUCKLED COLUMN NEAR CENTER OF PICTURE

The system of falsework used in the construction of the bridge consists of trussed I-beams underslung as shown in the accompanying photograph and drawings. These were supported at either end by column bents built up, as shown in the sketch, of 5 pieces of 2 in. x 10 in. lumber spiked together with the ten-inch side of the lumber set parallel to the center line of the bridge. The columns for the particular span which collapsed were approximately 30 feet high and were made up of several pieces of 2 in. x 10 in. of shorter length and which were spliced with the joints staggered. The I-beam trusses were braced by horizontal struts of 2 in. x 6 in. lumber as shown in drawing No. 2. No diagonal bracing was placed until after the buckling was first noticed.

Buckling of the composite columns was first noticed after about 25 yards of concrete had been poured in the span that later failed. Two of the outer columns on one bent buckled outward about 2 feet, causing a settlement of approximately 3 inches in the outer trusses supporting the forms. Work was stopped, the forms brought back to line by adjusting the wedges, and the columns cross-braced by spiking pieces of 2 in. x 10 in. lumber to them. Pouring was resumed but when about 75 yards had been poured additional buckling was noticed and within a short time the entire falsework had collapsed, throwing the span into the river. From the accompanying sketches it will readily be seen that the buckling of the two outer columns caused a downward deflection of the cap which threw the outer trusses out of the vertical, thus bringing an eccentric load on them, and causing their failure. The remaining trusses were carried along in the failure by the wooden horizontal struts previously mentioned.


No 1
A
15" I Beam
Wooden strut from one truss to other
8in Columns Made of five 2"x10" pieces
Note-These 2x10 that make up columns were set with face parallel to ℄ roadway, Causing buckling out away from ℄
30'0"
A
FALSEWORK SPAN E
PROJECT No 503.
By. E.R.Boney
Traced by N.L.

SHOWING UNDERSLUNG FALSEWORK TRUSSES



SHOWING HOW COLUMNS BUCKLED

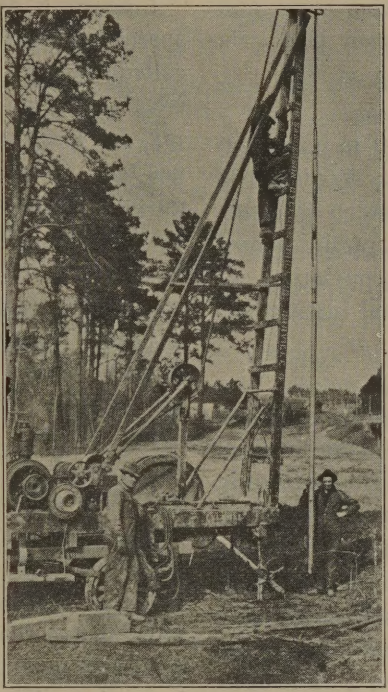
Cable-Churn Drill Shows Character *of* Bridge Foundations

By P. K. Schuyler, *Assistant Engineer*

IN the design of bridges one of the most important items is the accurate knowledge of foundation conditions as they exist at the site of the proposed structure. Without such information the footings of the bridge cannot be correctly designed nor can the necessary quantities be determined.

The Bridge Department of the State Highway Commission has made investigations of various kinds in designing structures on the State Highway System and has made use of drills of various kinds. The necessity of more definite information has become apparent and a number of different types of drills are being tried out. The earth auger and wash boring outfit give information as to the elevation of the surface of the rock, if any, that underlies the site of the bridge, but neither of these methods are of any value in determining whether a boulder, a thin strata of rock incapable of sustaining a foundation, or solid rock is encountered.

There are several different types of drills that may be used in drilling through rock but the initial cost together with the cost of operation of some of the types make their use prohibited. One of the most satisfactory of the above mentioned types is the cable-churn drill which is shown in the photograph accompanying this article. This drill operates inside of a casing pipe in the same manner as an ordinary well drill. With the entire outfit mounted on a truck, movement of the drill from one job to another is quickly accomplished.



Cable-Churn Drill Used in Foundation Investigations

The drill described above and shown in the photograph has been tried out at the site of the proposed Neuse River bridge and has proven very satisfactory. The results of the borings taken show a rather unusual condition for this section of the State. On the south bank of the stream, solid bed-rock was found at about the elevation of the stream bed but on the north bank no rock was found although borings were made to a depth of forty feet. Piles will therefore be used under all piers on the north side of the stream while those on the south side will be carried to bed-rock. From the information obtained the structure can be designed as it will be built, thus effecting quite a saving in extra depth concrete, which is always an expensive item.

Contracts *to be* Let April 3rd.

(Continued from page 4)

derson County lines. Bids are asked on grading, drainage, and standard types of hard-surfacing.

Plans may be seen at the office of District Engineer at Marion, N. C.

Ninth District

Project No. 930-A, Graham County, consists of surfacing, with penetration or waterbound macadam, 2.92 miles on route No. 108, near the town of Robbinsville. The grading on this project was done as No. 930.

Project No. 944, Haywood County, consists of grading, draining, and hard-surfacing 11.66 miles of route No. 10 between Waynesville and Canton.

Project No. 961-A and extension, Macon County, consists of grading and surfacing with penetration or waterbound macadam, 8.27 miles of highway from the end of project No. 960, now under construction, and Little Tennessee River, on route No. 286.

Project No. 971, Madison County, consists of 6.74 miles of State highway, between Hot Springs and the Tennessee State line, on route No. 20. Bids are asked for grading, drainage, and surfacing with gravel, shale, or waterbound macadam.

Plans may be seen at the office of District Engineer at Asheville, N. C. Plans may also be seen on all of the above projects at the Raleigh offices of the Commission. All projects will be let under the 1923 Specifications, copies of which may be obtained from the Commission.

"What North Carolina *is* Doing"

(Continued on page 4)

gram over several years' period. It is my opinion that we are going to have at the expiration of the expenditure of this $50,000,000.00 enough additional tax caused by the expenditure of this road money to pay every single dollar of it, and I want to tell you that some of these new citizens of North Carolina are going to come to our State from Virginia. We have heretofore populated the Eastern Shore of Virginia by North Carolinians moving to your territory, but now they are coming back home, and when once again they get the "tar" on their heels you are going to lose some good Virginia citizens.

Schools Going Along With Roads.

North Carolina's activity is not confined to our road-building program. We are today spending $25,000,000.00 in public school houses. We have today under construction, and just being finished, 800 new public school houses within the State. We are also appropriating additional buildings at our higher educational institutions amounting to about $6,000,000.00.

What the People Say.

But to get to the point, what do the people of North Carolina say about this expenditure? We have biennial terms of the Legislature, and just prior to the convening of the 1923 Legislature the State Highway Commission was convinced that we would have our expenditure for roads so far advanced that we would need additional money before the 1925 Legislature convened, so we prepared a bill increasing our gasoline tax from one cent to 3 cents per gallon, and asking for an additional $15,000,000.00 bond issue for road construction. This passed the House of Representatives by a vote of 88 to 9. The Senate Committee took it up without argument, and approved it. Today I assume that it will pass by an almost unanimous vote in the Senate. This, I think, shows what the people of North Carolina think of our road program. You may be sure that the legislator in North Carolina, and I assume in Virginia, has his ear closer to the ground than any animal living, and listening to the rumblings of public opinion.

Completed Roads Save Gasoline

Some of you may say that we are taxing our people to death. No we are not. Here are some figures that will prove to you that the people of North Carolina love to be taxed when it is a paying investment. In 1920 there were shipped into the State 73,997,832 gallons of gasoline. There were at that time 142,284 automobiles in the State, or each automobile in 1920 used 520 gallons of gas. In 1921 there were shipped into the State 73,492,968 gallons of gasoline, and we had at that time 149,901 automobiles in the State, or each automobile consumed during the year 1921 490 gallons of gas. In the year 1922 we had shipped into the State 86,125,368 gallons of gasoline, and we had 181,955 automobiles, or each automobile in 1922 consumed 463 gallons of gas. This will show that a saving of each automobile in 1922 over 1920 was fifty-seven gallons of gas. This can be accounted for only by the improved roads in 1922 over 1920. This fifty-seven gallons of gas, multiplied by an average price of 25 cents, was a net saving to each automobile of $14.25, or a saving to 181,955 automobile owners amounting to the tremendous sum of $2,592,587.50. This is a saving in gasoline alone, not to mention the saving in oil, time and the wear and tear of your machine and religion.

I heard a distinguished citizen of Virginia make a speech in North Carolina on this road subject, and he called my attention to the fact that gas was selling in North Carolina, even though we had a 1 cent per gallon tax, for less than it was in Virginia where you have no gas tax. This gentleman was no other than your distinguished Governor. Since that time I have made some investigations, and find that in comparing similar places North Carolina and Virginia gasoline is selling from 1 cent to 3 cents per gallon cheaper in North Carolina than it is in Virginia. What is the price of gas in Roanoke today? (Some one answered 25 cents per gallon.) We are paying 20 cents to 21 cents per gallon in Raleigh and Winston-Salem; in towns similarly located to Roanoke the price of gas today is from 21 cents to 23 cents per gallon. Why this difference in the cost of gas in Virginia and North Carolina? There can be only one answer. Somebody at No. 26 Wall Street, New York, names the price of gasoline in both Virginia and North Carolina. They must figure the original cost of the gasoline, plus railroad transportation, plus truck delivery to the distributing point. The original cost in both instances must be the same. Your railroad transportation is less, I think, but certainly no more. Your truck distribution is very much more on account of your bad roads, and this is, I am sure, the reason that you are paying more for gasoline than we are in North Carolina today. It amounts to this—that you are actually paying for the roads and not getting them, while we are paying for them and getting them.

Politicians Cannot Stand in Way.

Now some one has said that there are some political reasons why your road program will not pass in your Legislature. I don't believe that any politician or set of politicians, in Virginia can, to save his, or their life, or lives, withstand the united action of the advocates of this road movement. This is an organization that demands that Virginia take some care of its citizenship, and I am sure that by a united action you will succeed. I said in the beginning that all civic development comes either by evolution or revolution. I say to you now to insist upon your road legislation that will enable you by evolution to have a road system, if you can, but by political revolution if you must.

What Other States Are Doing.

The love of Virginians for Virginia is proverbial. I

(Continued on page 18)

Reasonable Interpretation *of* State Highway Specifications

(Continued from page 5)

treatment of a contractor by an engineer or his inspectors should never be countenanced.

Long arguments, however, are dangerous. Oftentimes an unreasonable or impractical requirement will creep into a specification, similar to the following:

"Piles must be cut when the sap is down."

Suppose a job were let in the month of May, must the contractor wait until the following winter before cutting and driving his piling?

Some points in connection with the 1923 specifications may be of interest. Under the 1922 specification for drainage ditches the engineer could require the contractor to bring material from a point 1,000 feet away from the road and place it in embankments. This might prove to be unnecessarily expensive to a contractor if the ditch extended through swampy ground or a heavy thicket.

The question of payment for unavoidable overbreaks and slides has been finally settled by allowing payment for classified excavation.

To supplement the specification and to make their interpretation work uniform and clear, the roadway cross-sections will be given in detail on blue prints for each project.

The stations, on which a given section is to be built, will be listed under that section.

So that on each project there will be several sections with a list of stations given under each.

There are several changes in the 1923 specifications which will undoubtedly assist the contractor without injuring the final quality of the work.

Lighter rollers will be allowed on fills with the result that more rolling will be done and the fills will have a longer time to settle before the surfacing is placed.

A minimum weight of two tons will be allowed, but if the weight of roller is less than three tons it must be made up of separate rings 4 to 8 in. in width, which vary in diameter from 6 to 8 inches. They are commonly called embankment rollers and have been satisfactorily used on reservoir and levee work.

Lighter rollers, five to ten tons, will be allowed on the subgrade for hard-surface work.

Placing fills in layers is still required, but each layer may be placed in two horizontal sections, provided the next layer above "breaks joint" with the one beneath.

The gravel specification has been revised to fit local conditions. The topsoil and artificial sand-clay specification has been separated into two items. The plowing and harrowing has been reduced from seven to three consecutive days and thereafter when the conditions are suitable.

The maximum size stone or gravel for coarse aggregate in concrete roadway and base course has been lowered from 2¾ in. to 2¼in., and tabulated grading requirements have been made. Screenings as a part of the fine aggregate will not be permitted. This will or should result in a more workable concrete, which can be more easily furnished.

Progress on shoulder and ditch work must be kept up to within 4,000 feet of the last surfacing laid. The shoulders and ditches may be built to the approximate section but not finally finished. This will give plenty of time for the soil to get settled and will prevent the subgrade from becoming soft and endangering the surfacing.

When cuts are widened to take borrow their depth must not be deeper than the adjacent subgrade.

The free haul limit on excavation and borrow will be 1,000 ft. and on topsoil, sand-clay and one course gravel will be 2,000 ft. Overhaul will be paid for at 1½ cents per cubic yard station of 100 feet.

Hauling over broken stone base course will be allowed provided it does not result in ruts.

The use of hydrated lime in roadway concrete may be employed up to 10% by volume of the cement. When lime is to be used, written permission from the Engineer will be given and the lime furnished by the State F.O.B. siding. The contractor will be paid a fixed price per square yard for hauling and placing.

Separate measurement of materials will be required, as before, the measurement being made in vertical compartments in the batch boxes, when used, or in separate containers outside the batch boxes and then dumped into them. In the case of hand-finishing of concrete roadways, it will be necessary to screed the concrete with the steel screed at least two times; two screeds may be employed.

The sprinkling of concrete must be maintained and the contractors should look well to their pumping equipment, source and quantity of water available. The laying of concrete roadway cannot proceed unless that already laid is being properly cured. The wetting for curing must be done during daylight.

Joints bars should be dipped or painted with heavy oil instead of tar or asphalt.

In reinforced pavements the steel will be placed 2½ in. from top surface instead of 2 in.

The maximum width of fabric sheets will be 9 ft. instead of 6 ft.

A tinker tamp will be used to precede the steel screed to secure greater density of concrete around the steel.

This will make a total of two tinker tamps and one steel screed for reinforced concrete roadways.

Natural rock asphalt will be laid to a prescribed thickness of 1½ in. instead of 2 in. and the concrete base course for this will be 5½ in. thick instead of 5 in.

The maximum size of stone for penetration macadam will be 2¾ in. instead of 2½ in.

Vitrified pipe will be triple strength instead of double.

Cast iron pipe may be either smooth or corrugated.

(Concluded on page 18)

STATUS OF STATE WORK IN NORTH CAROLINA

Projects Under Construction

NO.	COUNTY	LENGTH	TYPE	APPROXIMATE COST	BEGUN	CONTRACTOR
100	Beaufort	10.50	R.C.	$ 369,777.70	8—1-21	W. T. Hadlow.
101	Beaufort	4.23	P. C.	145,492.76	1-20-23	Public Service Production Co.
105A	Beaufort	2.00	P. C.	71,680.00	11-11-22	J. L. McGhee Cont. Co.
105B	Beaufort	5.037	P. C.	164,301.64	1-19-23	Public Service Production Co.
106	Bertie	7.12	T. S.	58,204.90	9-11-22	J. F. Mulligan Const. Co.–Boney & Hostetler.
113	Chowan	9.9	Graded	40,975.73	2—1-22	Nello L. Teer—Gregory & Talbot.
114	Chowan	10.00	Graded	45,064.09	1—3-22	Battershill & Goode—Gregory & Talbot.
125	Edgecombe	15.11	A. C.	428,438.76	2-28-22	R. G. Lassiter & Co.
131	Gates	13.50	T. S.	135,516.01	8-22-22	Bacon & Moore—W. D. Murray—Sadler Corp.
132	Gates	9.73	T. S.	63,921.00	8-29-22	J. A. Marrow.
133	Gates-Pasquotank	14.05	T. S.	138,050.00	11—7-22	C. W. Lacy—Pittsburg Des Moines Steel Co.
137	Halifax	5.67	Bit Mac	124,736.97	11-21-21	O. F. Leighton—A. C. House.
138A	Halifax-Northampton	12.59	S. C.	131,712.13	5—1-22	Nello Teer—Richards Bros.
145	Hertford	12.88	Graded	86,379.70	7-31-22	Jameson & Bro.—Atlantic Bridge Co.
151	Hyde	4.30	T. S.	71,422.78	12-10-21	C. W. Lacy—Porter & Peck.
152	Hyde	10.89	S. C	75,651.40	1-15-23	O. A. Mann & Co.
154	Martin	11.27	A. C.	394,090.74	4-17-22	Sou. Willite Paving Co.—O. F. Leighton, Inc.
155	Martin-Pitt	19.30	T. S.	98,176.65	1—9-22	J. P. Dicus—J. M. Gregory.
157A	Martin	12.41	T. S.	90,763.86	10-18-22	Jamison & Bro.—J. A. Marrow.
157B	Martin	12.36	T. S.	90,396.24	11-13-22	J. F. Mulligan Constr. Co.—Batson Cook Co.
159	Nash	11.22	Gravel	89,942.43	1—2-22	J. A. Kreis & Co.
160	Franklin-Wake-Nash	8.93	T S.	53,722.95	1-27-21	Chandler & Ragland—Southern Dray Co.
166	Northampton	0.47	Graded	17,954.75	3-20-22	W. D. Murray—Sadler Corp.
167	Northampton	20.48	T. S.	87,294.90	7-17-22	Virginia Contr. Co.—Bacon & Moore.
173	Perquimans-Pasquotank	7.22	R. C.	239,444.70	8-25-22	Williams & Williams.
174	Pasquotank-Camden	2.4	Cord	55,818.01	4—3-22	D. E. Williams.
175	Pasquotank	9.50	Brick	217,405.72	4—6-21	County Commissioners.
183A	Pitt	13.54	P. C.	399,854.40	11-13-22	S. J. Groves & Sons.
183B	Pitt		Bridge	32,343.30	3-27-22	B. J, Boyles.
184	Pitt	7.14	P. C.	206,516.42	11-21-22	Public Service Production Co.
185	Pitt	14.35	Graded	31,069.72	3-29-22	J. A. Marrow.
191	Tyrrell	6.91	T. S.	57,934.41	1-20-22	C. W. Lacy—M. M. Jones.
195	Washington	15.18	T. S.	65,619.35	2-28-22	L. M. Lee & Co.—B. J. Boyles.
196	Washington	14.93	T. S.	82,099.60	5-15-22	W. N. Thompson.
200	Carteret	13.68	Graded	79,629.00	7-21-22	Eagle Eng. Co.—Batson-Cooke Co.
201	Carteret	15.2	Graded	24,956.30	1-17-23	Duplin Constr. Co.—Batson Cooke Co.
210	Craven	8.34	A. C.	287,919.39	4—3-22	West Construction Co.—A. P. Gilbert.
211	Craven	9.93	A. C.	262,673.20	1-30-22	Union Paving Co.
218	Wayne-Duplin	16.06	Graded	80,804.50	8—4-21	C. W. Lacy.
219	Duplin-Lenoir	15.60	Graded	148,339.20	6-1—21	Chitwood & Palmer.
220	Wayne-Duplin	14.53	A. C.	358,460.00	2-27-23	Union Paving Co.
236 F A 143	Johnson	14.83	A. C.	475,321.55	10-2-22	R. G. Lassiter & Co.
245	Jones	15.76	Bit Mac	244,737.90	3-22-22	Hyde & Baxter.
254	Lenoir		Bridge	66,740.00	11-22-22	Roanoke Iron & Bridge Co.
256	Lenoir		Bridges	57,683.00	1-11-23	Englehardt-Kuehen.
263	Pamlico	12.03	A. C.	289,324.02	3-27-22	Union Paving Co.
264	Craven-Pamlico	0.14	R. C.	27,156.25	7-24-22	Rhyne & Kitchen.
272	Sampson	16.47	Graded	98,807.39	6-19-22	R. E. Martin—Striblin—Stauddy & Newell.
273	Sampson	2.44	P. C.	88,106.20	2-27-23	Eagle Engineering Co.
280	Wayne	10.01	A. C.	311,352.36	11-28-21	Union Paving Co.
282	Wayne	14.22	A. C.	352,880.00	11-11-22	Union Paving Co.
291	Wilson	7.63	A. C.	203,498.18	1-17-22	P. R. Ashby.
294	Wilson		Bridge	14,340.00	11-29-22	Stearns Bros.
300	Bladen	11.99	S. C.	65,189.90	4—8-22	T. W. Chandler—Nello Teer.
301	Bladen	13.17	T. S.	82,028.21	11-21-21	J. F. Mulligan—Powell Paving & Const. Co.
312	Brunswick	9.77	P. C.	247,319.68	7—5-22	Alabama Conc. Prod. Co.—Batson-Cooke Co.
313	Brunswick	3.44	A. C.	105,389.85	3-15-22	Sou. Willite Paving Co.—Roanoke Bridge & Iron Works.
314	Brunswick	15.82	S. C.	99,326.45	2-23-22	Hagedorn Const. Co.
316	Brunswick	12.12	S. C.	80,068.72	8-14-22	B. Frank Price—Batson, Cooke Co.
317	Brunswick		Bridge	18,893.82	11-30-22	Atlantic Bridge Co.
325	Columbus	11.22	T. S.	105,258.23	11—3-21	J. A. Kreis-Cornell-Young Co.
326	Columbus	13.61	S. C.	195,838.19	5-23-22	J. T. Plott—J. A. Kreis & Co.
327	Columbus	5.2	S. C.	38,269.44	6-21-22	J. A. Kreis.
328	Columbus	7.03	P. C.	219,371.68	12-26-22	L. L. Tindall
338	Cumberland-Sampson		Bridge	26,233.99	10-28-21	Roanoke Bridge & Iron Works.
339	Harnett-Cumb'l'nd	.754	T. S.	16,524.75	11-30-21	Porter & Boyd.
340	Cumberland	11.07	P. C.	381,032.02	6-15-22	Alabama Conc. Prod. Co.—Hobbs & Peabody.
342	Cumberland	5.91	A. C.	177,402.50	10-30-22	A. J. Wardrep.
351	New Hanover	10.64	A. C.	200,006.40	1—8-23	Southern Willite Paving Co.
364A	Onslow	9.95	S. C.	44,631.40	3-14-22	R. E. Martin.
364B	Onslow	12.84	T. S.	99,819.00	6-26-22	A. W. McClay.
375	Pender	15.56	S. C.	72,522.92	11-11-21	A. W. McClay.

STATUS OF STATE WORK IN NORTH CAROLINA—*Continued*

Projects Under Construction (Continued)

NO.	COUNTY	LENGTH	TYPE	APPROXIMATE COST	BEGUN	CONTRACTOR
376	Pender	7.64	Graded	$ 94,757.85	11-11-21	C. G. Kershaw Const. Co.—Cornell Young Co.
377	Pender-Duplin	1.61	S. C.	76,985.70	3-22-22	R. E. Martin-Hazell-Conerat-Quist Co.
378	Pender	14.12	W. B. Mac.	213,502.96	7-19-22	C. W. Lacy.
379	Pender	10.00	S. A.	100,000.00	5-22-22	State Forces.
380	Pender	8.98	W. B. Mac.	162,212.60	3—6-23	C. W. Lacy.
386-87	(F A-140) Robeson	9.86	P. C.	647,888.05	9-4-22	James O. Heyworth.
389	Robeson-Colum	1.56	T. S.	83,463.38	10-26-21	L. A. Chitwood.
391B	Robeson	1.10	T. S.	17,433.00	2-26-23	H. M. Beasley.
400	Chatham	....	Bridge	57,420.22	4-14-22	R. M. Walker & Co.
402	Chatham	6.92	T. S.	33,940.28	8—1-22	W. N. Thompson.
403	Chatham	7.01	Gravel	40,567.00	2-17-23	C. G. Kershaw.
411	Durham	5.81	P. C.	211,574.92	9-15-22	Hutton Eng. & Const. Co.
412	Durham	8.80	P. C.	252,582.33	11-15-22	L. L. Tindall.
419	Franklin	12.82	T. S.	63,021.97	7-27-22	Jamison Bros.—J. M. Gregory.
420	Franklin	1.56	P. C.	55,421.30	7-11-22	Chandler & Ragland.
428	Granville	4.19	R. C.	132,637.77	7-14-22	Pittman Const. Co.
456	Orange	9.00	Graded	37,459.07	1—7-22	Crawford & Crawford—Nello Teer.
460	Orange	9.87	A. C.	296,835.55	9-25-22	R. M. Hudson & Co.
463	Person	11.24	P. C.	327,171.35	8-14-22	Porter & Boyd.
473 {F A 146	Vance	7.83	P. C.	265,546.60	7-11-22	R. G. Lassiter & Co.
481	Wake	7.40	A. C.	252,925.15	1-24-22	Union Paving Co.—P. R. Ashby.
484	Wake	8.79	P. C.	311,629.40	8-23-22	P. R. Ashby-Booz-Lloyd & Co.
492	Warren	4.48	Bit Mac	100,436.13	4-10-22	Porter & Peck—A. C. House.
493	Warren	3.39	Bit Mac	77,866.80	7-27-22	Porter & Peck.
494 {F A 147	Warren	6.21	A. C.	208,130.01	9—6-22	Clifford Engineering Co.
501	Alamance	10.89	T. S.	32,627.10	12—7-21	W. M. Shook—Hanford Bros.
502	Alamance	17.43	T. S.	138,629.97	7-17-22	W. E. Graham—Hanford Bros.
503	Alamance	....	Bridge	59,450.38	7-17-22	Atlantic Bridge Co.
504	Alamance	5.22	A. C.	154,127.16	3-17-22	Elliott & Sholes.
511	Caswell	14.80	T. S.	74,192.58	12-12-21	White & Simpson—C. B. Hester.
512	Caswell	11.67	T. S.	49,432.30	2-19-23	J. T. Platt.
525	Davidson	10.24	A. C.	363,141.68	12-23-21	Elliott & Sons & Boggs—Austin Bros. Bridge Co.
528	Davidson	10.24	P. C.	427,511.92	10-2-22	Hagedorn Constr. Co.—J. A. Peterson.
532	Guilford	11.70	A. C.	387,499.20	2—1-22	Elliott-Sholes Co.
532B	Guilford	....	Bridges	27,203.00	....	L. M. Lowdermilk.
533	Guilford-Forsyth	10.50	P. C.	427,997.62	7-11-21	Royer-Ferguson Const. Co.
535	Guilford	7.78	R. C.	259,357.01	4-19-22	Leaksville Lumber Co.
544	Hoke	10.45	S. C.	32,445.49	5-16-22	O. A. Mann & Co.—Chitwood & Carpenter.
545	Hoke	9.15	T. S.	58,195.06	6—5-22	O. A. Mann & Co.—A. W. McClay.
546	Hoke	0.84	S. A.	27,948.80	11-27-22	Dawkins Constr. Co.
555	Montgomery	20.55	T. S.	82,646.00	2-19-23	Mayfield Construction Co.—E. P. Holder.
566	Moore	7.14	T. S.	61,380.66	3—6-22	Gibson Const. Co.—Nello Teer.
569	Moore	18.97	S. C.	97,141.45	8—1-22	Mayfield Const. Co.
577	Randolph	13.37	P. C.	411,375.77	4-18-22	Royer-Ferguson Co., Inc.—J. L. Brinkley.
588	Rockingham	7.98	R. C.	266,498.43	4-11-22	Cheatwood & Driscoll.
589	Rockingham	7.99	P. C.	324,975.31	10-30-22	Cheatwood & Driscoll—Atlantic Bridge Co.
593 {F A 38	Rockingham-Caswell	17.98	P. C.	12,530.98	7-11-22	J. A. Kreis.
600	Alexander	9.3	Graded	12,530.98	5-26-22	Bolton Construction Co.
601	Alexander	3.07	T. S.	33,630.45	4—3-22	Gus Ginn, Inc.—R. M. Thurmond.
602	Alexander	9.28	Bit Mac	189,329.80	10—9-22	W. E. Graham.
606	Stanley-Anson	....	Bridge	54,759.32	3-23-22	Concrete Steel Bridge Co.
607	Anson	6.39	T. S.	40,517.29	3-21-22	Geer & Wilson—Booz-Lloyd & Co.
608	Anson	7.88	A. C.	345,408.58	9-27-22	Lampton & Burks—J. A. Peterson.
614 {F A 144	Cabarrus	9.20	P. C.	350,085.07	7-21-22	A. L. Harris—Oliver & Costello Bros.
622	Catawba	10.85	A. C.	354,684.88	1-23-22	Union Paving Co.
629	Catawba	7.52	P. C.	268,662.48	6—5-22	A. L. Harris—R. M. Thurmond & Co.
630B	Gaston	6.65	A. C.	188,748.99	8—8-22	W. F. McCanless, Hobbs-Peabody Constr. Co.
632	Gaston	8.5	P. C.	291,868.94	1—2-22	Davis-Wilcox Const. Co.
633	Gaston	13.77	AC & Recon	180,000.00	1—6-23	Gaston County—P. M. Dietz.
639	Iredell	10.59	A. C.	387,448.42	1—2-22	R. M. Hudson Co.—Luten Bridge Co.
640	Iredell	8.17	Bit Mac	181,990.82	9-26-22	W. E. Graham.
647	Lincoln	7.10	P. C.	250,108.15	6—5-22	A. L. Harris —R. M. Thurmond & Co.
653	Mecklenburg	8.84	A. C.	308,182.44	2-28-22	Union Paving Co.—Luten Bridge Co.
654	Mecklenburg	10.1	A. C.	302,887.09	4—3-22	Lampton & Burks.
658	Mecklenburg	9.55	A. C.	270,704.92	10—9-22	Union Paving Co.
661	Richmond	9.76	T. S.	40,683.41	7-18-22	McDonald & Brooks.
665	Richmond	5.77	A. C.	194,501.23	7-28-22	A. J. Wardrep.
670	Cabarrus-Rowan	4.53	P. C.	142,221.53	6-29-22	Harris Construction Company.
673	Davidson-Rowan	0.59	Bridge	285,565.20	9-19-22	Hardaway Contracting Co.—Elliott & Sons.
677	Scotland-Robeson	7.11	R. & P. C	283,460.21	4-26-22	P.R. Ashby—J. B. Murphy.
691	Union	....	Bridge	14,519.83	2-13-23	J. S. Brinkley.
693	Union	1.0	Gravel	3,324.48	10- -22	Sykes-Collins Co.
694	Union	....	Bridge	23,549.13	11-14-22	Hagedorn Construction Co.
700	Alleghany	7.90	Bit. Mac	132,297.33	6-23-21	W. E. Graham.

STATUS OF STATE WORK IN NORTH CAROLINA---*Continued*

Projects Under Construction (Continued)

NO.	COUNTY	LENGTH	TYPE	APPROXIMATE COST	BEGUN	CONTRACTOR
701	Alleghany-Wilkes..	8.00	Bit. Mac	$ 153,863.60	6-16-21	W. E. Graham.
702A	Alleghany........	7.75	Bit Mac & Gravel	209,188.98	10-31-22	O'Brien Constr. Co.—Luten Bridge Co.
711	Ashe............	9.5	Gravel	60,000.00	9—7-22	Little Contracting Co.
712	Ashe............	11.06	Gravel	197,687.38	10-24-22	J. T. Plott.
713 {F A 139	Ashe............	....	Bridges	126,872.75	8-22-22	Concrete Steel Bridge Co.—R'dway not let.
724	Caldwell.........	4.66	T. S.	51,890.66	5—8-22	County Road Commrs—R. M. Thurmond & Co.
731	Davie...........	5.46	P. C.	195,393.11	3-13-22	G. R. Martin-Heilig & Sherrill.
741	Forsyth.........	8.90	P & R. C.	315,025.81	7-27-22	Hardaway Construction Company.
742 {F A 137	Forsyth.........	10.62	R. C.	385,127.60	6-20-22	Harris Construction Co.
744	Forsyth.........	2.0	T. S.	*...............	1-11-22	Forsyth County.
750	Stokes..........	14.86	T. S.	93,054.38	9-15-21	J. F. Mulligan Const. Co.—Lee J. Smith.
752	Stokes..........	9.67	T. S.	113,522.50	2-17-23	W. E. Graham.
761	Surry...........	2.22	P. C.	77,334.01	11-22-22	Geo. F. Martin.
765	Surry...........	3.4	P. C.	112,685.76	10-24-22	Campbell Constr. Co.
770A	Watauga.........	3.0	Bit-Mac.	30,000.00	8-12-22	State Forces.
771A	Watauga.........	2.5	Bit. Mac	40,000.00	9—7-22	State Forces.
771B	Watauga.........	13.5	Gravel	35.000.00	9—7-22	State Forces.
780	Wilkes..........	18.00	Recon	154,000.00	7-25-21	J. F. Mulligan.—State Forces.
781	Wilkes..........	14.50	Recon	30,000.00	7-25-21	J. F. Mulligan.—State Forces.
782	Wilkes..........	5.97	R. C.	184,614.65	3-29-22	Hyde & Baxter.
784	Wilkes..........	4.97	T. S.	85,966.21	8-30-22	J. F. Mulligan Constr. Co.—Foster Constr. Co
790	Yadkin..........	10.12	P. C.	308,123.42	4-24-22	Pittman Construction Co.
800	Avery...........	5.84	Grav & R C	198,827.02	7-24-22	O'Brien Const. Co.—J. A. Kreis.
811	Burke...........	5.24	P. C.	189,412.41	1-13-22	Southern Dray Co.
814	Burke...........	8.69	S. C.	13,459.60	8-15-22	M. A. Kollock.
821	Cleveland........	1.58	P. C.	60,192.33	10-31-22	Davis-Wilcox Constr. Co.
822 {F A 150	Cleveland........	10.47	P. C.	404,444.48	9-27-22	Elliott & Sons—J. A. Kreis & Co.
833	Henderson........	5.2	Gravel	38,412.44	1—3-22	S. L. Davis Const. Co.—Asheville Const. Co.
846	McDowell........	10.06	Gravel	204,680.74	9-22-21	Asheville Const. Co.—W. T. Taylor Const. Co.
847	McDowell........	4.00	Graded	98,443.90	10-19-22	C. W. Lacy—Oliver & Costello Bros.
848	McDowell........	....	Bridge	18,597.04	11-21-22	R. M. Thurmond & Co.
855	Mitchell.........	4.72	P. C.	174,398.78	9-12-21	Fiske-Carter Construction Co.
856	Mitchell.........	6.88	Bit Mac	239,005.80	3-20-22	Porter & Boyd—L. J. Chandler & Co.
858	Mitchell.........	....	Bridge	42,367.49	10-2-22	R. M. Thurmond & Co.
860	Mitchell.........	5.65	W. B. Mac	152,908.42	4-21-22	J. F. Mulligan—W. H. Anderson Const. Co.
866	Polk............	6.0	Bit.-Mac.	180,393.40	4—3-22	Dunn & Woodall—Henry Construction Co.
876	Rutherford.......	4.8	P. C.	146,264.80	10-30-22	Fiske-Carter Construction Co.
880	Rutherford.......	....	Bridge	24,679.43	4—4-22	Austin Bros. Bridge Co.
882	Rutherford.......	15.80	T. S.	89,010.46	9-20-22	C. R. Willard & Sons.
888	Yancey..........	15.22	W. B. Mac	230,499.94	10-10-22	The Luck Co.
901 {F A 148	Buncombe........	7.52	P. C.	340,150.10	11—6-22	R. C. Stephens—A. J. Wardrep
903	Buncombe........	2.58	A. C.	100,399.47	4-10-22	Asheville Paving Co.—R. C. Stevens.
904	Buncombe........	1.60	A. C.	81,079.35	3-13-22	Asheville Paving Co.—R. C. Stevens.
910	Cherokee.......	7.56	Gravel	76,743.59	5-24-21	Ross Bros.—W. T. Moore Conc. Prod. Co.
911	Cherokee........	10.33	Gravel	84,475.38	10-25-21	H. A. Wells—Southern Dray Co.
913	Cherokee........	10.33	W. B. Mac	95,554.80	8—8-22	Mills, Williams Construction Company.
920	Clay............	4.8	Gravel	54,875.81	1—9-22	E. A. Wilson & Co.—W. T. Moore Conc. Prod. Co.
921	Clay............	12.37	Gravel	123,929.52	10-24-21	Lee J. Smith Const. Co.—W. T. Moore Conc. Prod. Co.
930	Graham..........	12.90	Gravel	130,522.00	10-15-21	Lee J. Smith Const. Co.—C. M. Dicus.
940	Haywood.........	7.13	W. B. Mac	126,082.00	4-14-22	Alexander & Patton—H. A. Brown & Co.
950	Jackson..........	7.56	Gravel	145,313.30	6-13-21	Wright & Nave—O'Brien Const. Co.
951	Jackson..........	11.85	W. B. Mac	249,546.00	8-17-22	R. H. Wright & Sons—W. T. Moore Conc. Prod. Co.
952A	Jackson..........	10.22	Graded	164,126.60	8-17-22	Brooks-Calloway Company.
954	Jackson..........	1.68	P. C.	90,871.77	7—1-22	Mills, Williams Construction Company.
960	Macon...........	4.97	S. C.	69,100.57	6—6-21	J. T. Plott—J. E. Lane & Co.
961	Macon...........	4.77	T. S.	58,340.59	12—5-21	J. T. Plott—J. E. Lane & Co.
962	Macon...........	13.58	W. B. Mac	171,310.04	4-24-22	O'Brien Const. Co.—Griffin Const. Co.
963	Macon...........	8.68	Graded	124,354.01	11-10-22	Costello Bros.—Brooks-Calloway Co.
970	Madison-Yancey..	13.80	W. B. Mac	267,378.26	11-11-21	R. H. Wright & Sons—O'Brien Const. Co.
980	Macon-Swain.....	17.84	W. B. Mac	350,175.11	....	Costello Bros.—Condon & Condon.
990	Transylvania.....	8.87	W. B. Mac	151,238.89	6—5-22	Sam L. Davis Const. Co.—R. C. Stevens.

*Built by county

Projects Completed

NO.	COUNTY	LENGTH	TYPE	APPROXIMATE COST	COMPLETED	CONTRACTOR
139	Halifax..........	....	Bridge	$ 18,436.66	8-25-22	Chandler & Ragland—Porter & Peck.
140	Halifax..........	....	Bridge	10,542.60	5—5-22	Von Glahn & Talbott.
186	Pitt............	9.75	R. C.	260,816.60	8—5-22	Cheatwood & Driscoll.
209	Craven..........	2.65	P. & R. C.	108,609.34	2-15-22	Eagle Engineering Co.
227	Greene..........	6.81	A. C.	238.113.70	1-25-23	West Construction Co.—Union Paving Co.
255	Lenoir..........	0.82	A. C.	33,957.00	8-18-22	West Construction Co.
281	Wayne..........	....	Bridge	22,484.88	1-15-23	P. R. Ashby.

STATUS OF STATE WORK IN NORTH CAROLINA---*Continued*

Projects Completed (Continued)

NO.	COUNTY	LENGTH	TYPE	APPROXIMATE COST	COMPLETED	CONTRACTOR
388	Robeson	3.35	R. C.	$ 137,000.40	9-28-22	C. W. Lacy—Roanoke Bridge & Iron Co.
409	Durham	0.5	Gravel	6,140.64	8—7-22	J. P. Dicus.
410	Durham	2.3	R. C.	83,921.97	9-28-22	C. D. Riggsbee.
427	Granville	5.12	A. C.	159,097.62	1—4-27	R. G. Lassiter & Co.
436	Harnett	21.91	Gravel	144,318.14	1-15-23	C. G. Kershaw Const. Co.—Hobbs & Kitchen.
445	Lee	5.91	T. S.	18,692.85	1-15-23	C. B. Hester.
446	Lee	5.90	A. C.	197,188.22	5-24-22	Atlantic Bitulithic Co.—O. A. Mann & Co.
453	Orange	....	Bridge	33,706.80	1—9-23	Geo. W. Kane.
454	Orange	4.28	P. C.	192,006.15	3-6-22	Elliott, Sholes & Teer.
455	Orange	4.19	T. S.	46,415.77	9-28-22	J. F. Mulligan Const. Co.—P. R. Ashby.
482	Wake	6.64	A. C.	191,669.21	9-23-22	R. M. Hudson Company.
483	Wake	0.54	R. C.	19,989.75	8-7-22	C. D. Riggsbee.
500	Alamance	5.22	Graded	32,732.20	1-17-22	W. W. Tuck & Son—A. M. Hazell, Connerate—Quist Construction Co.
505	Alamance	0.42	S. A.	15,346.40	6-23-22	Hedrick Construction Co.
524	Davidson	0.3	S. A.	10,835.00	1-20-22	Town of Lexington.
525A	Davidson	.5	S. A.	17,978.73	6-27-21	Town of Lexington.
526	Davidson	3.76	P. C.	130,826.19	10-25-22	Hagedorn Constr. Co.—Heileg & Sherrill.
538	Guilford	....	Bridge	7,039.01	2-21-23	J. L. Brinkley.
539	Guilford	0.64	S. A.	21,639.20	1-19-23	Robt. G. Lassiter & Co.
540	Guilford	....	Recon.	15,000.00	1-23-22	J. T. Platt.
567	Moore	2.96	T. S.	7,600.00	9-18-22	C. E. Teague.
630A	Gaston	3.02	A. C.	91,020.46	7- -22	W. F. McCanless.
633	Gaston	3.02	A. C.	57,247.41	10—5-22	Gaston County—P. M. Dietz.
634	Gaston	....	Recon.	4,500.00	....	State Forces.
638	Iredell	7.88	A. C.	244,509.30	1-20-23	Thompson-Caldwell Co.
655	Mecklenburg	1.57	P. C.	62,028.68	7-31-22	Speed-Parker Co., Inc.—Luten Bridge Co.
656	Mecklenburg	10.4	Bit.-Mac.	200,000.00	10-30-22	State Forces.
657	Mecklenburg	1.38	Recon.	20,000.00	10-30-22	State Forces.
692	Union	2.28	A. C.	65,366.67	12-28-21	Redmon Construction Co.
695	Union	4.51	A. C.	130,655.46	9-14-22	Redmon Construction Co.
710	Ashe	3.14	P. C.	142,687.93	8-17-22	Pittman Construction Co.
719	Caldwell	....	Bridge	5,343.25	6-26-22	Cottrell & Howard.
722	Caldwell	7.00	Recon	12,000.00	1-18-22	County Forces.
725	Caldwell	4.00	T. S.	28,015.46	2-24-23	County Commissioners.
751	Stokes	7.25	T. S.	31,746.00	10-4-21	W. E. Graham.
760	Surry-Alleghany	6.9	T. S.	24,387.66	11-5-22	W. E. Graham.
764	Surry	1.63	R. C.	50,588.20	2—3-23	Leaksville Lumber Co.
801	Avery	.99	W. B. Mac	22,350.24	10-26-22	Geer & Wilson.
823	Cleveland	1.90	P. C.	81,234.01	8-15-22	Southern Paving Co.—Z. B. Weathers & Son.
844	McDowell	2.04	P. C.	57,048.42	12-13-21	Bolton Construction Co.
845	McDowell	7.19	Gravel	132,177.93	12-22-22	J. W. Stapp Constr. Co.—Praytor, Howton & Wood.
855B	Mitchell	....	Bridge	7,454.15	8-22-22	Luten Bridge Co.
866	Polk	6.00	Bit Mac	180,393.40	11-21-22	Southern Paving Co.—Henry Constr. Co.
877	Rutherford	9.87	T. S.	65,563.73	8—7-22	Geer & Wilson.
878	Rutherford	6.39	Gravel	50,913.50	10-27-22	Michaux Const. Co.—Geer & Wilson.
879	Rutherford	....	Bridge	5,737.38	6-21-22	Austin Bros. Bridge Co.
942	Haywood	0.57	Gravel	5,294.46	2—1-22	O'Brien Construction Co.

PROJECTS UNDER CONTRACT

NO.	COUNTY	LENGTH	TYPE	APPROXIMATE COST	CONTRACTOR
107	Bertie	....	Bridges	$ 50,127.00	Atlantic Bridge Co.—Roadway not let.
138-B	Northampton-Halifax	....	Bridge	347.188,74	Pensacola Shipbuilding Co.
147	Hertford	17.36	T. S.	73,580.00	Nelo Teer—Atlantic Bridge Co.
155B	Martin	19.3	P. C.	493,900.40	W. T. Hadlow.
163	Nash	14.96	P. C.	409,592.40	Public Service Production Co.
275	Sampson	....	Bridges	8,063.40	Rhyne & Kitchen—Roadway not let.
291B	Wilson	....	Bridges	11,809.30	Jno. M. Ogden & Co.—Roadway not let.
380	Pender	8.98	W. B. Mac	162,212.60	C. W. Lacy.
391A	Robeson	1.01	S. A.	43,332.08	R. G. Lassiter & Co.
429	Granville	6.94	P. C.	239,021.90	R. B. Sandidge.
590	Rockingham	2.10	P. C.	66,092.18	Geo. R. Martin.
615	Cabarrus	3.88	A. C.	98,741.17	Thompson-Caldwell Co.
671	Rowan	7.34	A. C.	310,714.14	Thompson, Caldwell Co.—Atlantic Bridge Co.
696	Union	6.05	A. C.	170,843.00	Redmon Construction Co
743	Forsyth	11.1	A. C.	376,441.30	Atlantic Bitulithic Co.
785	Wilkes	2.52	P. C.	78,703.50	D. J. Brookshire & Co.
815	Burke-Cleve-Lin..	11.63	T. S.	120,407.87	Geer & Wilson—J. L. Von Glahn.
953	Jackson	12.72	Graded	118,186.75	C. C. McCabe.
991	Transylvania	7.31	Graded	206,912.00	Gibson Construction Co.

STATUS OF FEDERAL AID WORK IN NORTH CAROLINA

Projects Under Construction

NO	COUNTY	LENGTH	TYPE	APPROXIMATE COST	BEGUN	CONTRACTOR
15	Guilford	4.205	Bit Mac	$ 5,441.75	9-1-17	County Commissioners.
61	New Hanover	2.186	P. C.	234,841.39	7-12-20	C. W. Lacy
69	Transylvania	9.348	W. B. Mac.	231,409.04	3-25-20	Allport & Alexander Construction Co.
94A	Mitchell	5.04	W. B. Mac.	190,375.13	6-22-20	Gibson Construction Co.
125A	Alleghany	4.99	Bit Mac	153,899.13	11-22-21	W. E. Graham
127	Wilson	7.63	Grading	30,827.50	1-16-22	County Commissioners.

Summary

Type	STATE Miles	STATE Cost	FEDERAL AID Miles	FEDERAL AID Cost
WORK UNDER CONTRACT				
S. A.	1.01	$ 43,332.08		$
P. C.	45.82	1,287,310.38		
W. B. Mac.	8.98	162,212.60		
A. C.	28.37	956,739.61		
Graded	20.03	325,098.75		
T. S.	28,99	193,784.87		
Bridges		417,188.44		
Total	133.20	$ 3,385,666.73		$
WORK UNDER CONSTRUCTION				
P. C	278.92	$ 9,829,980.54	2.19	$ 234,841.39
R. C	71.01	2,439,934.26		
A. C.	265.04	8,152,820.12		
S. A.	10.84	127,948.80		
Bit Mac	88.78	1,749,983.43	9.19	159,340.88
W. B. Mac	127.37	2,170,409.02	14.39	421,784.17
Brick	9.50	217,405.72		
T. S.	390.99	2,698,331.09		
S. C	152.42	1,078,883.76		
Gravel	129.91	1,603,292.09		
Graded	165.64	1,056,298.78	7.63	30,827.50
Recon	21.50	184,000.00		
Cord	2.4	55,818.01		
Bridge		896,458.58		
Total	1,714.32	$ 32,300,518.83	33.40	$ 846,793.94
WORK COMPLETED				
P. C	19.34	$ 774,440.72	26.56	$ 889,940.67
R. C.	17.57	552,316.92		
A. C.	46.00	1,408,825.05	42.29	1,521,368.25
S. A.	1.86	65,799.33	22.91	763,048.82
Bit. Mac	16.40	380,393.40	30.62	798,895.02
W. B. Mac.	.99	22,350.24	14.00	303,505.78
T. S.	41.08	222,421.47	509.18	5,228,132.54
			83.90	785,198.22
Gravel	36.56	338,844.67	42.56	488,699.18
Graded	5.22	32,732.20	21.60	221,598.67
Recon.	8.38	51,500.00		
Bridges		110,744.73		651,051.10
Total	193.40	$ 3,960,368.73	793.62	$ 11,651,438.25

Total Roadway . . . . 2,867.94. Total Cost . . . . $52,096,825.85.

LEGEND

P. C.—*Plain Concrete. R. C.—*Reinforced Concrete. A. C.—*Asphaltic Concrete. S. A.—*Sheet Asphalt. Bit. Mac.—*Bituminous Macadam. W. B. Mac.—*Water Bound Macadam. T. S.—†Top Soil. S. C.—†Sand Clay. Gravel—†Gravel. Graded—†Graded. Recon.—†Reconstruction. Cord.—†Corduroy..

* Hard Surface. † "G" Type.

Corrected to March 1, 1923.

Gravel Road Construction *in* 7th District

R. W. Parks, *Construction Engineer*

THERE is under construction, by State Forces, about seventy miles of gravel roads in the Seventh District. Some of this work was begun in the fall of 1921, and about forty miles have been completed. The material for this surfacing has been secured from all possible sources, river beds, creeks, branches and gravel banks. It has required a great deal of manipulation to get a satisfactory surface, as much of the material used would have been rejected under the specifications for a gravel surface in its natural state. Most of the gravel contained an excess of large material. It was necessary to utilize this large material in some way as it would have been impossible to secure enough finer material to meet our needs.

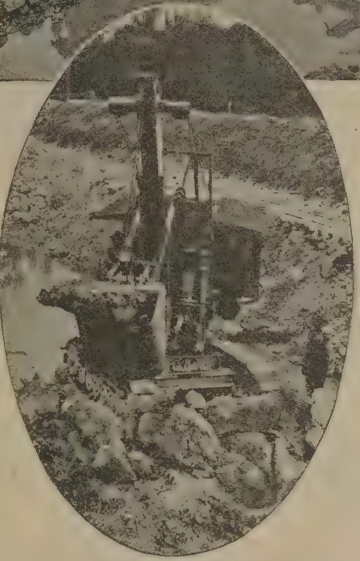
The following method was tried out and found very satisfactory:

No attempt was made to grade the gravel while being loaded, everything from sand to 6 or 8 in. gravel being loaded as found in the bed. This material was not dumped directly on the subgrade, but on the edge of the gravel previously placed. This was then raked and shoveled forward in such manner as to place the large stone on the bottom and the finer material on top. This surfacing was then machined frequently, until it had compacted and the loose stone brought to the surface by each machining was raked to the ditch-line. Then a small portable crusher, driven by a 14 h. p. gasoline engine was pulled along the center of the road and this large material along the ditch-line was run through the crusher and allowed to drop directly on the road-bed where it was spread smoothly and evenly over the surface. This crushed material runs from 2 in. down and it has been found that it compacts and bonds in the surface under traffic very satisfactorily.

By the use of this crusher much material has been utilized that would have been wasted. In fact, it was absolutely necessary to utilize it in some way as there was not enough material of suitable quality available. The point I wish to emphasize is the satisfactory work done by these small crushers. It proved to be much more economical than trying to crush the gravel in a large crusher before placing it on the road.

I think the addition of one of these portable crushers to the Maintenance outfit on a gravel road would be a good investment, because after each machining and dragging there is some loose stone that has to be removed. This could be piled along the edge of the road instead of being thrown away, as at present, and when a sufficient amount had been accumulated it could be crushed and put back on the road. Also, when a gravel surface becomes so rough as to make it necessary to scarify it, a big percentage of the large material is brought to the surface and wasted. This material could be utilized and there is no question but that it makes a splendid wearing surface. It also makes a better surface for surface treatment, if such is desired.

THIS SOUTHERN CONTRACTOR HAS FOUR "8-IN-1" MACHINES



C. W. Lacy, Wilmington, N. C., contractor, who operated three P & H 206 Machines—one shovel and two as draglines—has added a fourth P & H to his equipment—a 210 Dragline.

In response to an inquiry from a Georgia contractor, he wrote: "Replying to your letter, 21st inst., asking if I have a P & H 210 Machine for sale, will say that I have not. I am now operating three 206 Machines, two as draglines and one as shovel and do not care to sell either; on the other hand, I have a - - - - - Steam Machine I would like to sell and replace with a P & H."

Note: Since the writing of this letter the fourth P & H was purchased.

"THE BEST ALL-AROUND MACHINERY HE EVER OWNED"

A Houston, Texas, contractor also wrote to Mr. Lacy for his opinion of P & H Excavating Equipment. The telegram sent is evidence of the satisfaction and economy of the P & H. "Have three P & H 206 Machines, two operating as draglines, one as shovel. Shovel now loading limestone rock for crusher plant and giving excellent results. I expect now to replace all my steam machines with this type shovel as I consider them the best all-around piece of machinery I ever owned."

The P & H quality of design and construction is responsible for such consistent performance—which in turn has resulted in such widespread use. Ask for Bulletin 57-X

PAWLING & HARNISCHFEGER CO.
3853 National Ave., Milwaukee, Wis.

SALES AGENTS:
Tractor & Machinery Sales Company
1631 Broad St., Richmond, Va.

Same Machine with Crane Boom and Dragline Bucket

PAWLING & HARNISCHFEGER CO. P AND H **GASOLINE SHOVEL**

OSGOOD
Heavy Duty

REVOLVING
STEAM
SHOVELS

Save Time and Labor

Osgood ¾ yd. H. D. Breaking up Concrete Paving

¶ See an OSGOOD at work. Observe the speedy and snappy response to the operator. Then write for our Bulletins and find out why OSGOODS are famous for large output at low maintenance and operating cost.

The OSGOOD COMPANY
MARION, OHIO, U. S. A.

"What North Carolina *is* Doing"

(Continued from page 10)

like the way you say "Virginia." It sounds like a mother speaking to her child, or a man caressing his sweetheart, but look to your laurels, Virginia. Maryland on your North is building a good roads system. West Virginia on your West has a bond issue that is going to construct their roads, and North Carolina on the South of you is just as sure to have the best road system of any State in the Union as I stand here. I don't want to make any comparisons. Comparisons are always odious, but you dig into the statistics yourselves and you will find that North Carolina in agriculture is progressing faster than your State. Our manufacturing plants have improved more than the manufacturing plants in your State. Our population is increasing faster than the population of Virginia. It is a matter of fact that the percentage of birth rate in North Carolina is the largest of any State in the Union, and I tell you that unless you wake up and pass your road legislation and get busy with your roads that the comparison in the next ten years with your neighbor States will not show complimentary to Virginia.

I hope you will throw off the shackles of any political or other hindrance that is preventing you doing your duty toward your citizenship, and that we will soon have the pleasure of shaking hands at the meeting of a completed State highway system at our State line.

Reasonable Interpretation *of* State Highway Specifications

(Continued from page 11)

Concrete pipe will be tested for 1,000 lbs. by the three-point bearing method instead of 1,500 lbs.

The requirements per mix of concrete and curing are omitted but the pipe must pass the strength and absorption tests.

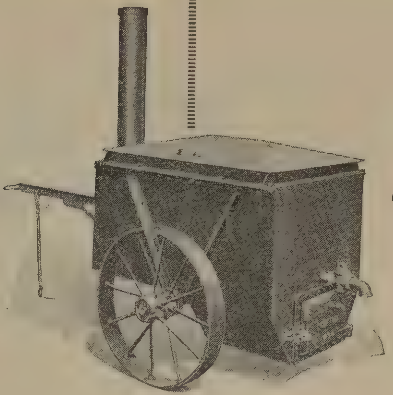
Every successful engineer as well as any other professional or business man realizes that he must keep his work up to the best current practice; for this reason specifications should be studied and revised annually.

Work and policies must be carefully watched throughout the construction period, and any desirable changes should then be included in the annual revision.

The old saying that we should never abandon a policy or method simply because it is old or change to new methods simply because they are new, applies to construction and specifications.

We must know why we do things in order to perform intelligently.

LITTLEFORD
TAR AND ASPHALT HEATERS



FOR ROAD AND STREET WORK

℄ No matter what kind of pavement is being laid or maintained, there is an unfailing need for heated bitumen and when required the supply must be ample and continuous so that the job will progress uniformly. Littleford Tar and Asphalt Heaters are giving many contractors this dependable service and they can do the same for you.

℄ Our new catalogue, just issued, contains many types of tar and asphalt heaters and other equipment for contractors on road and street work. Copy will be sent on request.

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ASPHALT
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HOW MUCH ARE YOU PAYING OUT
As the Cost of Loading Your Concrete Mixer?

The men who have made the long profit on this year's road contracts *have not* paid the price of hand shoveling. They have cut the payroll and used machinery—a one-man Loader at the sand and stone stockpiles. The difference in cost has paid a big return on their equipment investment—in some cases paid for it free and clear.

The men who are looking ahead choose Haiss Loaders because their cost per unit of work done is lower. They do more work because they alone have a combination of powerful digging buckets, positive self-feeding propellers, and a slow-speed crowding gear to keep the machine always digging into the pile—all working simultaneously. And the machine is built stronger, requires less maintenance and is good for a longer life.

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The Pipe that locks effectively, that prevents Separation and assures alignment to perfection.

The pipe which solves culvert renewal problems with least expense, greatest efficiency. The pipe that does not rot or disintegrate, the pipe that is mechanically correct and has proved itself the solution of the culvert problem.

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TWO MEN, without the use of any tools whatsoever, will unload, handle and install all sizes up to and including 36 inches in diameter.

It is as cheap to handle and install as clay pipe WITH NO BREAKAGE LOSS. In shallow trench work the entire culvert can be built up, interlocked and rolled into place in one operation.

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"ARMCO"
INGOT IRON
CULVERT
INSTALLED IN
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(*Copy of original letter*)

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July, 5, 1922

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Gentlemen:

We can inform you that the long lines of 48" and 60" Armco Corrugated Culvert bought from you in 1913 and installed through our village lots here have just been inspected and found in excellent condition.

We consider these Culverts one hundred per cent satisfactory. In fact, we are today ordering additional 48" Armco Culvert from you to supplement the 60" lines.

Yours very truly,
REVOLUTION COTTON MILLS,
(Signed) George P. Stone,
Superintendent.

GPS:AFR

ARMCO Resists Rust Ingot Iron

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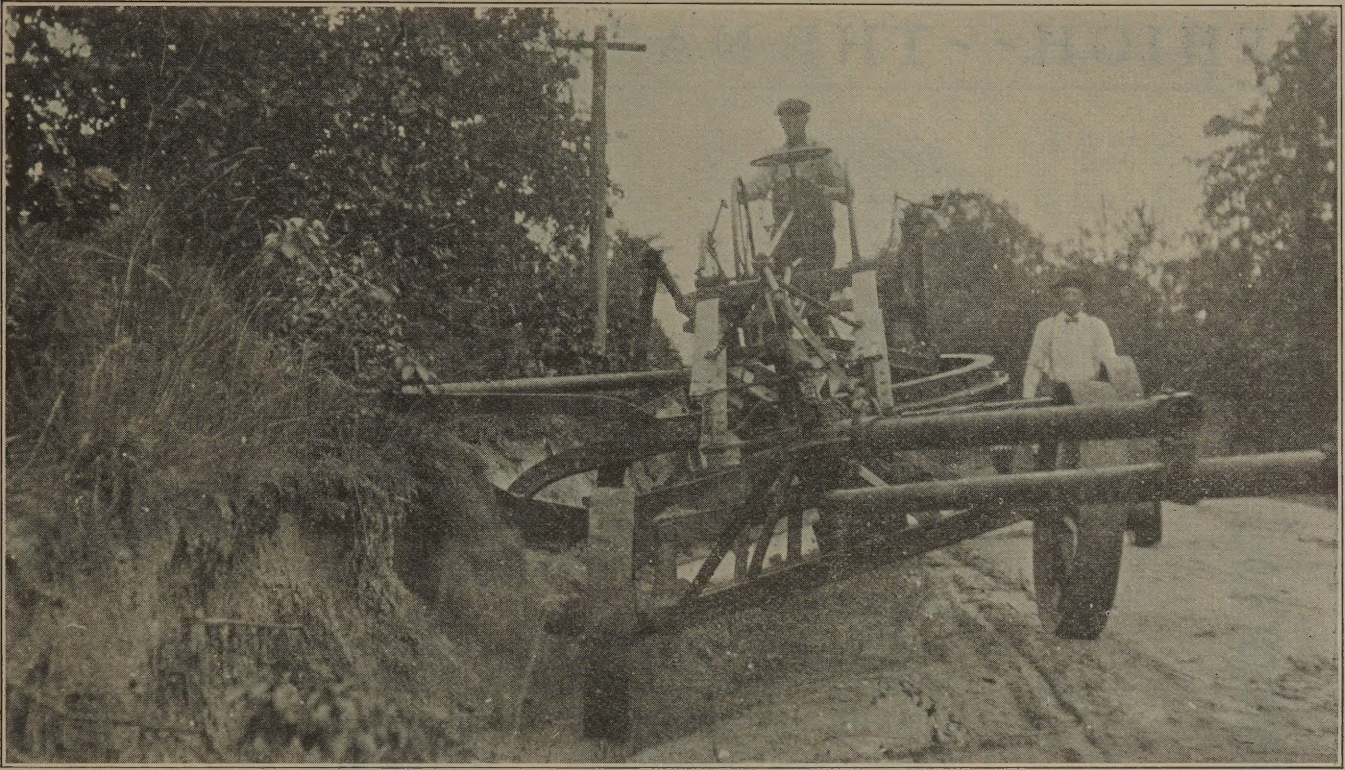
ATLANTA, GEORGIA
JACKSONVILLE, FLA. LITTLE ROCK ARK.

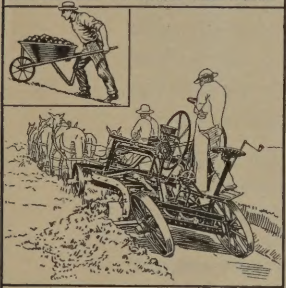
ARMCO Resists Rust Ingot Iron



One of the North Carolina State Highway Department's No. 12 Road King cutting down a rough ditch bank

in North Carolina

HE LEANS TOWARD THE LOAD



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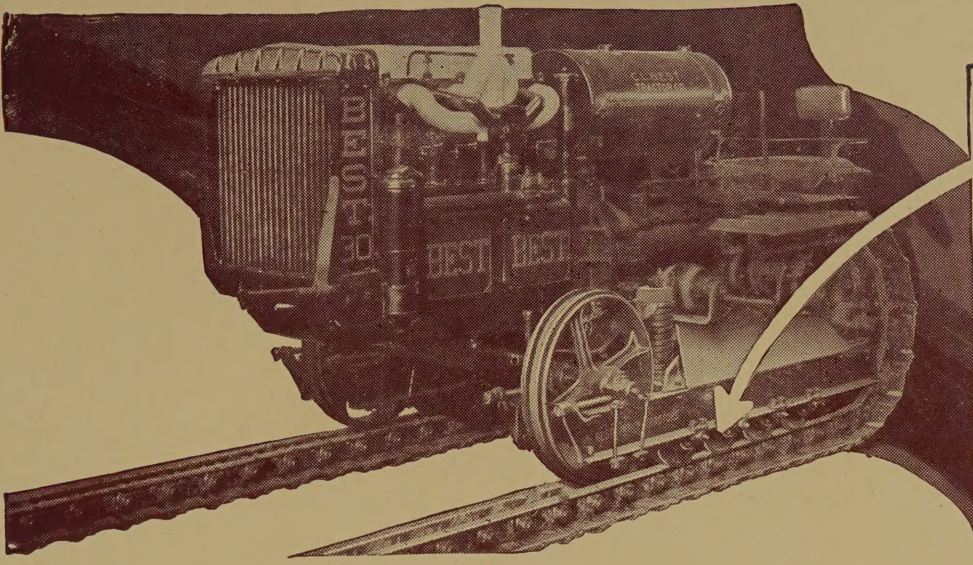
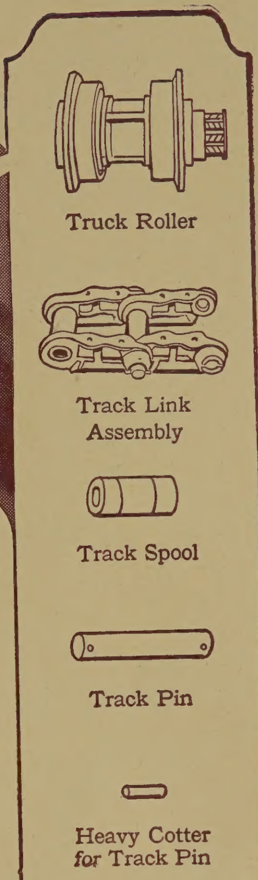
ANNUAL CAPACITY 16 MILLION BARRELS





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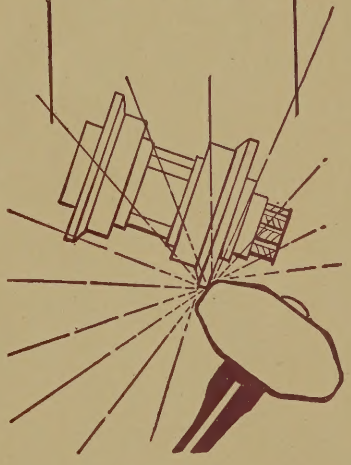
THE DRIVING WHEELS of the most powerful locomotives have forged steel rims.

The Truck Rollers of a track type tractor support the weight of the tractor and the flanges of rollers must withstand severe jars and side strains of side hill work and rough going.

On Best Tractors the flanged rims of truck rollers are drop forgings—nothing less—forged into shape under heavy steam hammers, from heated steel of special analysis. After being forged the rims are annealed, bored and reamed, then turned true on the outside tread. They are next shrunk on accurately machined hubs—being hardened at the same time—hardened to resist battering blows just as are the heads of first-class forged hammers or sledges.

The rollers, complete, are mounted on anti-friction bearings to insure easy running, bearings with seals to retain lubricant and to prevent entrance of sand and ruinous grit.

The truck rollers of Best Tractors run over tracks which are true and straight. Tracks are made from drop forged hardened links which have been accurately machined top and bottom and large hardened spools and pins at each joint contribute to the long life which may be expected from the tracks on Best Tractors.



"When Greek meets Greek." Both the sledge and the flanged roller rims are hardened drop forged steel.

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